Cost-effective energy efficiency in refurbished university buildings

– St Michael's House, University College Chichester

- Free consultation via the Design Advice scheme
- Independent heating zones
- High-frequency fluorescent lighting
- Optimum design appraisal
- 16% reduction in CO_2 emissions compared to conventional design solutions

BEST PRACTICE PROGRAMME

ENERGY EFFICIENCY

GOOD PRACTICE CASE STUDY 394

INTRODUCTION

St Michael's House is a late 18th Century Grade II listed building forming part of the Bognor Regis Campus of University College Chichester. It has a gross floor area of approximately 2000 m^2 split between four floors.

This Case Study illustrates some of the energy-efficient design features that were installed during the refurbishment of St Michael's House in 1999. They demonstrate that energy efficiency measures can be cost-effective when installed during building refurbishment projects.

DESIGN APPROACH

The College's brief was to provide a quality working environment that would not only be attractive to staff and students, but could also be used for private lettings in the commercial conference market.

There was an early recognition that simply choosing the 'lowest cost' options for the design would be unlikely to deliver a building that would meet the high specification required by the College. Furthermore, it was likely that it could also lead to excessive running costs both in terms of energy use and maintenance requirements. The College management was, therefore, keen to explore the use of energy-efficient design solutions as a means of achieving a quality installation without incurring excessive costs.

DESIGN ADVICE

Energy-efficient plant and equipment was a key consideration and so the College sought specialist advice from the Government's Design Advice scheme (see box below). The free consultation identified a range of energy efficiency opportunities, most of which were adopted by the design team. This Design Advice report highlighted potential energy-saving opportunities for the design team to consider.

This Case Study outlines two of the measures adopted, both of which are considered likely to be cost-effective as refurbishment projects for many higher education (HE) establishments:

- multiple heating zones
- high-frequency fluorescent lighting.

DESIGN ADVICE

Design Advice is a **free** environmental consultancy service with two principal aims:

- to improve the environmental performance of the UK's building stock
- to assist construction professionals and their clients to create buildings that are economical to operate through improved energy efficiency.

Design Advice is a government service, managed by BRECSU, that operates through a UK network of approved consultants. It is available to all new-build and major refurbishment projects with a floor area in excess of 500 m^2.

For further information on Design Advice telephone **0800 585794** or visit the website **www.designadvice.co.uk**

BEST PRACTICE PROGRAMME
DESIGN ADVICE

HOST ORGANISATION

'Major refurbishment projects represent a rare opportunity to incorporate energy efficiency and other quality features into a building.

At St Michael's House we sought to take full advantage of this opportunity by specifying that energy-efficient design solutions should be used wherever they were cost-effective.'

Mike Sellens
Head of Estates & Premises
University College Chichester

HIGH-FREQUENCY FLUORESCENT LIGHTING

The College's primary objective was to take full advantage of the opportunities for the provision of a quality lit environment for staff, students and private lettings.

The decision was taken to specify fluorescent luminaires fitted with high-frequency (HF) electronic ballasts. These offer significant operational benefits over mains-frequency switchstart fittings. The HF fittings have lower running costs, longer tube life, and avoid the subliminal flicker which some people find uncomfortable.

LIGHTING CONTROLS

The light fittings used in most teaching and office areas utilised 'intelligent' controls, each one incorporating an integral passive infrared presence detector along with an auto-dimming photocell. The setpoint for dimming is adjustable such that it can be set to maintain a level of 500 lux for teaching and office areas.

The energy cost savings for the twin tubed 1500 mm T8 fittings used in the corridors are illustrated in the table below.

The use of HF ballasts has therefore saved energy costs of £5.88 per fitting. The extra capital cost was £11.50 per fitting, representing a payback of around two years.

Typical teaching room with HF fluorescent lighting

Energy savings are, however, only part of the picture. The economic operating life of fluorescent tubes is extended by as much as 50% when driven by HF ballasts. The selection of HF lamps produces payback periods of two to five years when considering replacement costs alone.

	High frequency	Switchstart
Circuit power per fitting	110 W	144 W
Annual electricity use per fitting (based on 2880 hours use per year)	16.8 kWh	414.7 kWh
Annual electricity cost per fitting (@ 6p/kWh)	£19.00	£24.88

Showing annual energy cost savings of HF lamps compared with switchstart

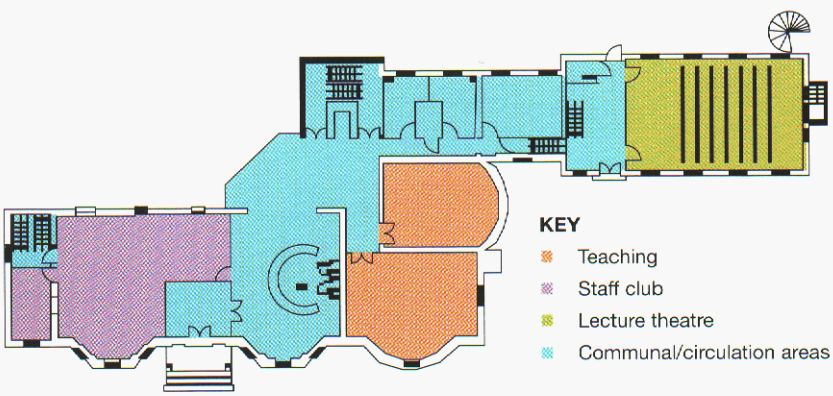
MULTIPLE HEATING ZONES

Historically, St Michael's House had been heated using a single low-temperature hot water radiator system that not only served the whole building but also two smaller, neighbouring premises: Arran House and the geography block. As part of the refurbishment project these two satellite buildings were separated from the St Michael's heating system and provided with their own gas-fired condensing boilers.

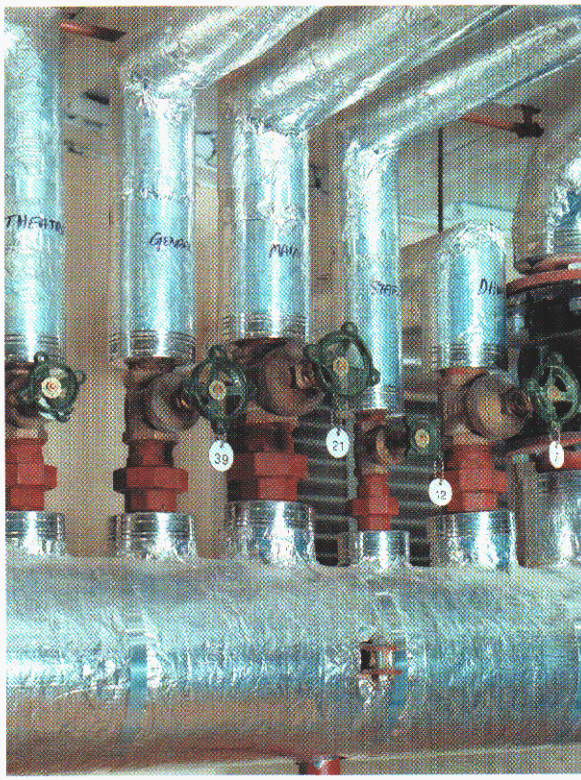
Four separately pumped heating zones were established to serve areas of St Michael's House with differing occupancy patterns:

- a principal variable temperature (VT) weather-compensated zone serving radiators in the offices and teaching rooms, further sub-divided by floor
- a VT zone serving radiators in the staff club rooms
- a constant temperature (CT) zone serving air handling fan convectors within the lecture theatre
- a VT zone serving radiators in the circulation areas (stairwells and corridors).

Separate time schedules were provided for each of the first three zones. The circuit serving the circulation areas was linked to these so that they operated when any of the others were on.



The various heating zones within St Michael's House



The boiler flow header showing heating zone connections before valve insulation was applied

A programmable controller located within the building's boiler room provides independent time and temperature control for each zone. This allows adjustments to be made from a single point and, as other buildings become upgraded to similar standards, can be incorporated into an estate-wide building management system.

The installation of multiple heating zones incurred additional expenditure of around £7500 for the purchase of extra pumps, pipework and controls. The payback on investment in energy savings alone is estimated to be around five years. This is based on the accrued energy cost savings compared with the 'typical' benchmark for HE academic buildings.

CONCLUSIONS AND FURTHER READING

CONCLUSIONS

The use of proven energy efficiency features such as multiple heating zones and HF fluorescent lighting has provided University College Chichester with the high-quality, flexible working environment that they sought.

In addition, valuable energy savings have been delivered which will offset the extra costs involved, while also reducing emissions of carbon dioxide. The estimated savings of 16% are based on an assessment of the reduced consumption of electricity due to HF lighting and lower heating gas consumption due to reduced heating hours in each of the independently controlled zones.

The features adopted at St Michael's House will be just as cost-effective in many other building refurbishment projects within the HE sector.

This Case Study is based on material drafted by Briar Associates under contract to BRECSU for the Energy Efficiency Best Practice programme

ENERGY EFFICIENCY BEST PRACTICE PROGRAMME DOCUMENTS

The following Best Practice programme publications are available from the BRECSU Enquiries Bureau. Contact details are given below.

Energy Consumption Guide

54 Energy efficiency in further and higher education – cost-effective low energy buildings

Fuel Efficiency Booklets

10 Controls and energy savings
12 Energy management and good lighting practices

General Information Report

40 Heating systems and their control

Good Practice Case Studies

42 Energy efficiency in higher education buildings: condensing gas boilers
334 The benefits of including energy efficiency early in the design stage – Anglia Polytechnic University

Good Practice Guides

74 Briefing the design team for energy efficiency in new buildings
160 Electric lighting controls – a guide for designers, installers and users
187 Heating system option appraisal – an engineer's guide for existing buildings
199 Energy efficient lighting – a guide for installers
207 Cost-effective low energy buildings in further and higher education
245 Desktop guide to daylighting – for architects
246 Building management systems in further and higher education

The Government's Energy Efficiency Best Practice programme provides impartial, authoritative information on energy efficiency techniques and technologies in industry and buildings. This information is disseminated through publications, videos and software, together with seminars, workshops and other events. Publications within the Best Practice programme are shown opposite.

Visit the website at **www.energy-efficiency.gov.uk**
Call the Environment and Energy Helpline on **0800 585794**

For further specific information on:

Buildings-related projects contact:
Enquiries Bureau
BRECSU
BRE
Garston, Watford WD25 9XX
Tel 01923 664258
Fax 01923 664787
E-mail brecsuenq@bre.co.uk

Industrial projects contact:
Energy Efficiency Enquiries Bureau
ETSU
Harwell, Oxfordshire
OX11 0RA
Tel 01235 436747
Fax 01235 433066
E-mail etsuenq@aeat.co.uk

Energy Consumption Guides: compare energy use in specific processes, operations, plant and building types.

Good Practice: promotes proven energy-efficient techniques through Guides and Case Studies.

New Practice: monitors first commercial applications of new energy efficiency measures.

Future Practice: reports on joint R&D ventures into new energy efficiency measures.

General Information: describes concepts and approaches yet to be fully established as good practice.

Fuel Efficiency Booklets: give detailed information on specific technologies and techniques.

Introduction to Energy Efficiency: helps new energy managers understand the use and costs of heating, lighting, etc.